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| **2A - Cell parts, cell functions, cell reproduction MN SCIENCE STANDARDS ADDRESSED** |
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| It is expected that the learner is **already familiar** with the chemistry of the cell, the structure and function of the cell membrane, and active and passive transport as addressed in the Minnesota State Science Standards:  9.4.1.2.1  9.4.1.2.2  9.4.1.2.5 |

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| 1. Organisms use the interaction of cellular processes to as well as tissues and organ systems to maintain homeostasis. | 9.4.1.1.1 | **Explain how cell processes are influenced by internal and external factors, such as pH and temperature, and how cells and organisms respond to changes in their environment to maintain homeostasis.**  • Rules of the universe are things and events in the universe that “occur in consistent patterns that are comprehensible through careful systematic study”; scientific theories and natural laws are the result of that systematic study (Project 2061, Atlas of Science Literacy, Volume 2, [American Association for the Advancement of Science, 2007], 5)  • A theory is defined as “a well-substantiated explanation of some aspect of the natural world that can incorporate facts, laws, inferences and tested hypotheses” (National Academy of Sciences, Teaching About Evolution and the Nature of Science, [National Academy Press, 1998], 5) • A law is defined as “a descriptive generalization about how some aspect of the natural world behaves under stated circumstances” and that carries the weight of scientific evidence (National Academy of Sciences, Teaching About Evolution and the Nature of Science, [National Academy Press, 1998], 5) • Items may require students to apply their knowledge of scientific theories and natural laws to a context • Items will NOT require students to define scientific theory or natural law |
| 2. Cells and cell structures have specific functions that allow an organism to grow, survive and reproduce. | 9.4.1.2.4 | E**xplain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.**  • Cell organelles will be referred to in MCA test items as cell parts • The cell part related to respiration in eukaryotes is limited to the mitochondria (transforms energy to a usable form for the cell)  • The cell part related to photosynthesis is limited to the chloroplast (converts light energy to chemical energy) • Cell parts related to protein synthesis in eukaryotes are limited to nucleus (site of transcription) and ribosomes (site of translation) • Structures related to protein synthesis in prokaryotes are limited to genetic material (site of transcription) and ribosomes (site of translation) • Cell parts related to cell reproduction in eukaryotes are limited to the nucleus (site of replication), genetic material (DNA), nuclear membrane (nuclear barrier), cell membrane (cytoplasmic barrier) and cell wall (cytoplasmic division) |
| 2. Cells and cell structures have specific functions that allow an organism to grow, survive and reproduce. | 9.4.1.2.6 | **Explain the process of mitosis in the formation of identical new cells and maintaining chromosome number during asexual reproduction.**  • Items may require students to know that mitosis is part of the process that produces cells that are genetically identical with the same number of chromosomes • Items addressing the process of mitosis may include knowing the sequence of events • Items assessing this benchmark may also assess benchmark 9.4.4.2.5 |
| 2. Matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways. | 9.4.2.2.1 | **Use words and equations to differentiate between the processes of photosynthesis and respiration in terms of energy flow, beginning reactants and end products.**  • Items will refer to reactants and products of cellular respiration as oxygen, glucose, carbon dioxide, water, ATP • Items will refer to reactants and products of photosynthesis as carbon dioxide, water, oxygen, glucose • Molecular formulas will include labels, for example water (H2O) • Items will NOT require students to understand absorption spectra • Items will NOT require students to recognize light reactions or the Calvin cycle • Items will NOT include glycolysis, Krebs cycle, electron transport system or fermentation |
| 2. Personal and community health can be affected by the environment, body functions and human behavior. | 9.4.4.2.5 | **Recognize that a gene mutation in a cell can result in uncontrolled cell division called cancer, and how exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.** |